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ABSTRACT

Recent advances in cognitive psychology provide insights into thinking processes and learning behavior that can help teachers prepare students for the demands of the workplace. Studies of successful students have found that the depth of their information processing is directly related to the quality of their learning outcomes. That is, more successful students classify, compare, contrast, analyze, and synthesize information with the goal of comprehension rather than memorization. The importance of individual cognitive differences suggests that students should be taught the cognitive processes or strategies that contribute to successful performance. Therefore, the content of vocational education needs to be expanded to include problem-solving, self-monitoring, and learning skills. Vocational education should teach an integrated knowledge base of generic core concepts, procedures, pattern recognition, and specific vocational skills. Vocational educators can accomplish this by specifying cognitive skills as explicit goals or objectives; combining direct, indirect, and introspective instructional strategies; integrating strategies to help students learn by rule, discovery, and reflection; and serving as mediators for students as they think about thinking and the successful and unsuccessful thinking processes that they use. Curriculum planners should bear these same concerns in mind when developing learning and problem-solving strategies for curriculum components and selecting curriculum materials. (MN)

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OVERVIEW

ERIC DIGEST NO. 53

Clearinghouse on Adult, Career, and Vocational Education

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ON SECOND THOUGHT: USING NEW COGNITIVE RESEARCH IN VOCATIONAL EDUCATION

The changing workplace is placing increased emphasis on an employee's ability to learn. Today's employers want employees who know how to learn. Today's workers must continue to acquire new skills and adapt existing skills to different environments.

Vocational educators need to provide learning environments that enable students to develop the thinking skills they need for problem solving and learning throughout their careers. Recent advances in cognitive psychology provide insights into thinking processes and learning behavior that can help teachers prepare students for the demands of the workplace.

The Thinking and Learning Process

Cognitive psychology is concerned with "understanding the nature of human intelligence and how people think" (Anderson 1980, p. 3). One current view of thinking is that it is a human information processing system intervening or mediating between the learning environment and the learners problem-solving behavior. Components of this system are sensory input and perception, memory, control processes (metacognition), and output and response mechanisms (speech, muscles, limbs). Studies of successful students have found that the depth of their information processing is directly related to the quality of their learning outcomes. That is, more successful students classify, compare, contrast, analyze, and synthesize information with the goal of comprehension rather than memorization.

A new view of learners, learning, and intelligence is emerging. Intelligence is now seen as a set of thinking and learning skills that can be modified. Focus has shifted from intelligence tests to the cognitive processes underlying the tests and educational performance.

This new perspective identifies the differences between novice and expert problem solvers. Problem solving requires extensive, accessible conceptual and procedural knowledge. Expert problem solvers appear to have more accessible knowledge and cognitive skills, in part because they organize knowledge in large chunks grouped into clusters, making what they know more retrievable.

Expert problem solvers also use different cognitive strategies and processes. The most important (and most transferable) of these are metacognitive, or general controlling processes. Several researchers have identified the following processes as keys to satisfactory problem solving:

- planning—recognizing and defining a problem, deciding upon solution processes, and sequencing the processes into a strategy;
- problem representation—deciding how to represent problem information;
- self-monitoring or self-management—evaluating a solution and the feedback received from it. (Laster 1985)

In addition to differing metacognitive processes, individuals differ in their cognitive styles. Cognitive styles define the way individuals receive information, form concepts, and retain and process information. Cognitive styles comprise one dimension of learning styles. As Keefe (1979) defines them, learning styles include characteristic cognitive, effective, and physiological behaviors that indicate how learners perceive, interact with, and respond to the environment.

Learning: Constructive, Adaptive Action

According to Laster (1985), the most persuasive new concept emerging from cognitive psychology is the notion that learning is a building process: knowledge and understanding are "constructed" by individuals as they process information from the environment, from their memories of previous experiences, and from their semantic structures.

Learning involves processing information into coherent chunks of knowledge that are then combined into knowledge structures for use in future learning, problem solving, and decision making. When faced with learning new information, students attempt to organize it by alphabetizing, visual imagery, or any means that makes it easier to recall. When solving problems, people actively interpret the problem and invent problem-solving procedures as needed.

This inclination to invent can lead to creative solutions, but misconceptions can also result. Teachers need to apply corrective feedback and look below surface answers to the rules and concepts guiding student actions. Correcting incorrect answers is likely to be ineffective unless the instructor also corrects the faulty rule being followed.

This new view of learning has given rise to the concept that learners are not passive consumers of information. Learners determine what they learn by the decisions they make; therefore, inadequate learning is due to inadequate decision making. Learners are often unaware of the learning deficiencies that lead them to faulty decision making. Dansereau (1978) notes that individual aptitudes or strategies may be the primary causes of performance differences. The importance of individual cognitive differences suggests that students should be taught the cognitive processes or strategies that contribute to successful performance.

What to Teach and How to Teach It

These research findings provide information about the thinking skills and processes needed for successful learning. What do they mean for vocational instruction?

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First, the content of vocational education needs to be expanded to include problem-solving, self-monitoring, and learning skills. An *integrated knowledge base* of generic core concepts, procedures, pattern recognition, and specific vocational skills should be taught. The recurring message in the findings of cognitive psychology research is the importance of this structured knowledge base, organized to be readily retrievable and accessible through the application of problem-solving, self-monitoring, and learning skills.

Which instructional strategies foster the development of this knowledge base and thinking and learning skills? Laster (1985) suggests that teachers do the following:

- Specify cognitive skills as explicit goals or objectives. Cognitive objectives state a set of changes in the thinking processes students use to perform tasks.
- Use examples and models that illustrate the distinguishing characteristics of a procedure, condition, or concept.
- Provide opportunities for practice with appropriate feedback. Not only does practice develop needed skills, but repetition of the same operations can lead to the discovery of more effective or efficient procedures.
- Combine direct, indirect, and introspective instructional strategies. The latter include thinking out loud, examining the thinking processes used, and evaluating the strategies used to perform a task.
- Combine strategies to help students learn by rule, by discovery, and by reflection. However, keep in mind that direct instruction might be most appropriate for novices and low-ability students.
- Serve as mediators for students as they think about thinking and the processes they use that are successful or unsuccessful. For example—
  —attend to verbal and nonverbal cues,
  —use tasks that transfer existing strategies to new domains, and
  —list the procedures students use and do not use in task performance to develop insight into strategic choices.
- Devise a means of evaluating students' knowledge base, skills, cognitive styles, and cognitive deficiencies before, during, and after instruction.

Suggestions for Curriculum Planners

Here are other ways to apply cognitive psychology concepts to vocational curriculum and instruction (Laster 1985):

- Use curriculum materials that require students to process information to form concepts, procedure rules, and patterns of conditions needing action.
- Develop a learning and problem-solving strategies curriculum component for use in high school and adult programs.
- Institute an information processing approach to learning. Tasks should be occupation specific with problems incorporated as a means not an end for learning.
- Develop condition patterns and procedure rules for vocational programs.
- Develop model career development systems for high school and adult vocational education. Such models might integrate reading, writing, computation, communication; interpersonal skills; problem solving and decision making; and learning, self-monitoring, and motivation.

REFERENCES

This ERIC Digest is based on the following publication:

Laster, Janet F. *Toward Excellence in Vocational Education: Using Cognitive Psychology in Curriculum Planning*. Information Series no. 297. Columbus: The National Center for Research in Vocational Education, The Ohio State University, 1985. (ERIC Document Reproduction Service No. ED 254 656).

Additional References

Anderson, J. R. *Cognitive Psychology and Its Implications*. San Francisco: W. H. Freeman and Company, 1980.

Dansereau, D. F. "The Development of a Learning Strategies Curriculum." In *Learning Strategies*, edited by H. F. O'Neil, Jr. New York: Academic Press, 1978.

Keefe, J. W. "Learning Style: An Overview." In *Student Learning Styles*. Reston, VA: National Association of Secondary School Principals, 1979. (ERIC Document Reproduction Service No. ED 182 859).

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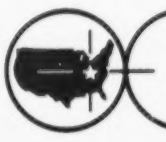

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